THE DESIGN OF HYBRID VIRTUAL STORE LAYOUT (HVSL): A SIMULATION EXPERIMENT OF INDONESIAN CUSTOMERS' CONTEXT

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AUTHOR'S CONTRIBUTION:

This work was carried out in collaboration between all authors. Author IM designed the study, wrote the protocol, managed the literature searches, interpreted the data, wrote the paper, produced the initial draft and revised the manuscript. Author MF anchored the field study, gathered the initial data and gave technical support. All authors read and approved the final manuscript.

Case Study

ABSTRACT

This article aims to develop a hybrid virtual store layout (HVSL) to compare the major conventional store layouts as grid, freeform and racetrack in term of customer's perceived in purchasing behavior. The design of HVSL and the conventional store layouts were tested to respondents by giving them feedback for each developed constructs after completing the virtual purchase. The reliability analysis with Cronbach's alpha shows that all the questions of the constructs are acceptable and the test validity shows that the questions of the constructs are correlated or valid. Moreover, the outcome of one-way between groups ANOVA parametric, which was used to test the hypotheses with post hoc comparison test (Tukey) shows that the proposed HVSL gives better results than the conventional store layouts: freeform and racetrack on the constructs, while HVSL is superior than grid layout on the constructs of time spent and information provided.

Keywords: Facility layout; store; hybrid; retailing.

1. BACKGROUND

Facility layout strategy is one of the important decisions in related to the long term effective operation [1]. It has also significant impacts to improve competitiveness of the company in term of optimizing capacity, processes, flexibility, costs, corporate image building and customer's satisfaction. An effective layout could support the implementation of corporate business strategy which could be differentiation, low cost strategy or customer responsiveness. Bazargan-Lari [2] found that there is significant impact of layout design on costs, wastes and capital investment. An improvement can also be achieved developing an effective layout such as customer satisfaction, labor productivity and delivery time [3, 4].

Web-Based retail layout or known as Virtual Store Layout (VSL) has different and unique approach in relation to allocate the space with various products with objective is to give a better response to customers [1]. The idea of VSL is based on the use of interactions between human (customers) and

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computers in somehow to improve sales and profit of different products shown on the space of the store. The impacts of the different type of VSL have been discussed in term of its relations to some aspects such as customer willingness to purchase [5], traffic and sales [6, 7] and consumer behavior [8]. In showing the product to customers virtually, most prior research in VSL discussed three different layout such *grid, racetrack and free-form* which of those three types have different advantages [9-11]. The three conventional VSLs are transformed into web or virtual layouts for computer interfaces over the internet website and then tested on the real customers.

The grid VSL, which is set based on the parallel aisles to one another, is generally used by common groceries for customers who have planned their purchase [9, 12].The freeform type is set the layout asymmetrically which gives customers to enjoy and free movement. This form which is generally used by fashion stores, leads customers to browse the store and increase the willingness to purchase along the time [9, 12, 13]. Meanwhile, racetrack is arranged aisles based on the themes so that customers will provide an interesting, entertaining and experiencing shopping [13].

Due to the increasing of customization where each customer has different objectives in visiting store virtually and customers are differentiated by ages, gender and economic levels, while the internet access (fixed and mobile) especially in the developing countries gets better currently, it is important to develop a VSL which considerate all the parameters found in the existing three different VSL types. This article designs a new VSL, Hybrid Virtual Store Location (HVSL), by accommodating all the conventional VSL types. HVSL attempts to combine all the functions of those three VSL types so it can rise customer satisfaction in order to increase product sales.

2. LITERATURE REVIEW

2.1 Conventional Store Layout Retailing

The strategy in store's layout has significant implication on customer's behavior on purchase. The problems to decide a fit layout strategy in store rises due to a limited space availability to display all products to provide excellent customer service. The implications of store layout on customer behavior in purchase in store are exist [14-16]. According to Levy & Weitz [9], store layouts in retailing are conventionally classified into three different layout, grid, freeform and racetrack layouts. Grid store layout is designed for fast shopping activities where customers are supposed to locate and find stuffs easily. The products are displayed on the both sides of parallel aisles of the large extent store's space based on the certain category so customers can move through the entire store (see Fig. 1). Most supermarkets, groceries and drug stores are the example stores using this particular layout. In freeform store layout, the floor and aisles are set freely and asymmetrically that all different types, size and shapes are displayed in the same sections.

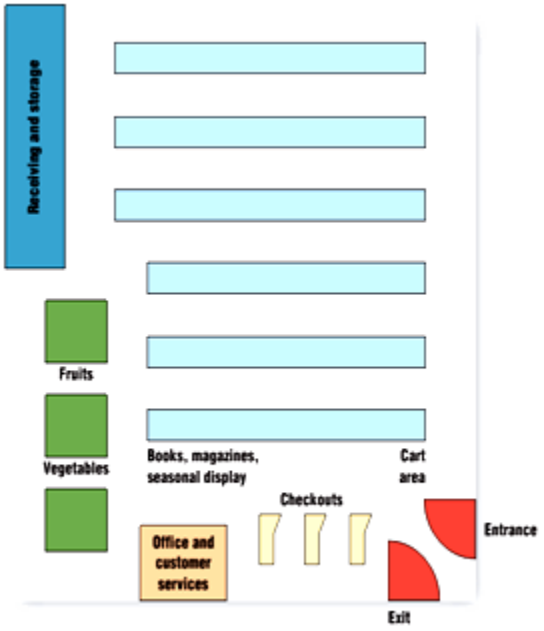

Fig.1. Grid store layout

Employing this type allows customers to move and browse stuffs to all directions within the stores (see Fig. 2) and leads customers to increase their willing to purchase stuffs instead of their shopping lists due to spend longer time in the store. Most large department stores as fashion stores are applying this layout type. In racetrack store layout, the floor is modeled into separated areas based on the same particular stuff's theme (see Fig. 3). In this type, customers can move along the stores' sections because this layout is designed to facilitate them to visit as many as store's sections. This store layout gives a different and interesting shopping experience to customers [13].

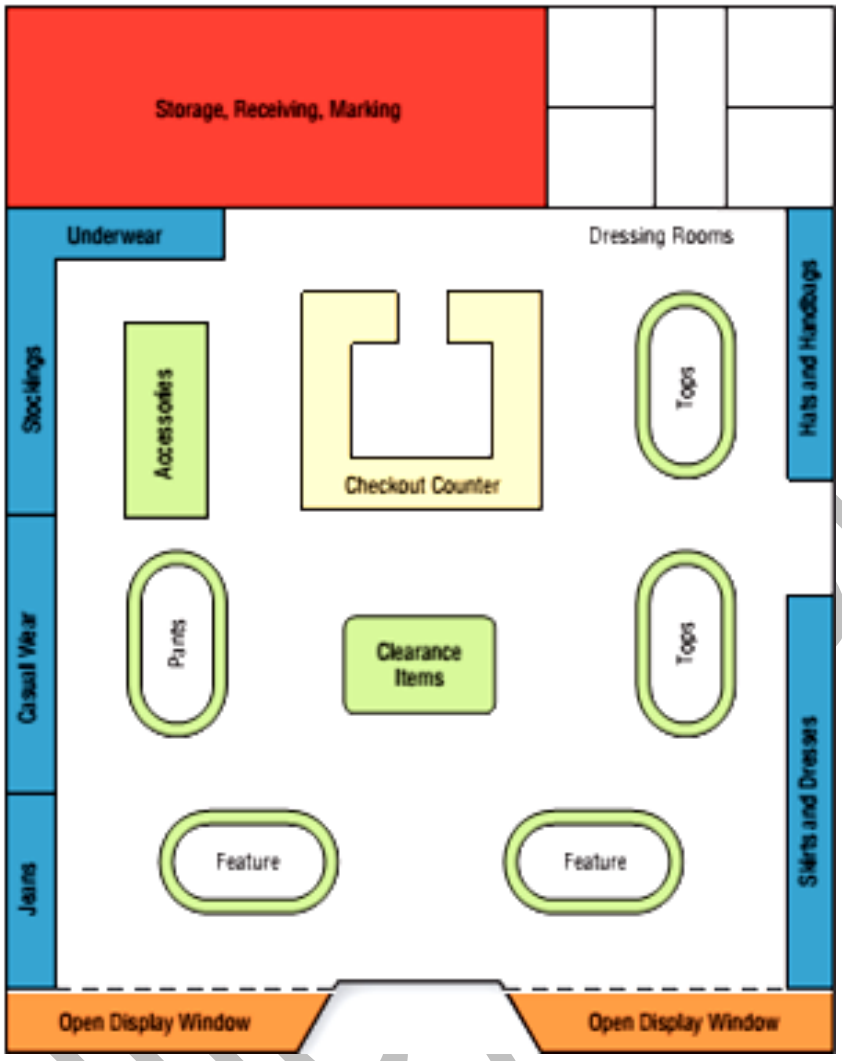

Fig. 2 Racetrack store layout

2.2 The Implication of Virtual Store Layout

The growths of World Wide Web and internet users have impacted significantly on the online business especially on the business to customers (B2C). The increase of internet users worldwide which reached 361.9 million in 2003 [17] has created opportunities for this electronic business by transforming all conventional activities within business processes to electronic activities. One of the promised online businesses which use internet is retailing. It is reported that E-shopping has valued up to US$ 500 billion by 2002 [18]. Virtual retailers recently use internet not only for display purposes but also for other functions as ordering process and online purchasing process. Moreover, for a big corporate point of view, the concept of virtual store might become the solution to minimize the costs of supply chain management from the long channel of supply by cutting function of the "real" retailing stores and replacing it into virtual store. It is investigated that by online selling strategy in the multi echelon supply chain business impact on pricing and ordering decisions, which are reducing costs of supply chain [19]. Moreover, virtual store layout decisions is potentially giving customers more information needed about the stores and developing customers' elaboration and response the other products or brands. Griffith [14] found that different VSL gives different results in the level of customers' elaboration and customers' outcome.

There are also some discussions of VSL applications and its implications in customers' behavior. It is investigated that the virtual store layout influences planned customers behavior [20, 21]. For example, for customers who have routine and planned behavior in shopping in the particular stores, grid virtual store layout facilitates is better VSL than others because they could do pre-selection the stuffs before

purchasing [9, 13, 22]. Prior study about racetrack VSL indicated that it is the most entertaining conventional VSL for customers for purchasing the stuffs via internet is racetrack, therefore this type leads customers to spend more time in the store for shopping [23, 24].

Further previous study also indicate that more time spent by customers for browsing the store by online using this type of VSL [25-27]. The same phenomena in the freeform VSL that customers are willing to spend more time in the store for shopping due to enjoy the freedom of move within the store.

2.3 Proposed Design: Hybrid Virtual Store Layout

In this research, hybrid virtual store layout (HVSL) is developed by accommodating each function of conventional store layout. HVSL allows customers to choose accessing the stuffs within the store in three different ways based on the customers' needs. The structure of HVSL is shown in Fig. 5.

The HVSL is structured based on the three conventional VSL's functions, for example, racetrack type in HVSL is provided for customers who have not long enough time to browse the stuffs within store, while grid type is provided in HVSL for customers who want to buy planned purchase and *Free-form* layout is covered for customers who have not plan to purchase while having a limited time in the store. The characteristics of three conventional store layouts on the customers' purposes are shown in Table 1.

Fig. 3. Free-form store layout
Source: [28]

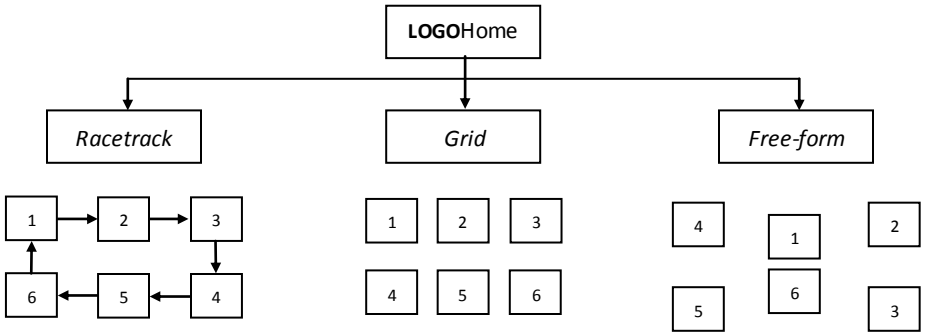

Fig. 4. Website structure for hybrid layout

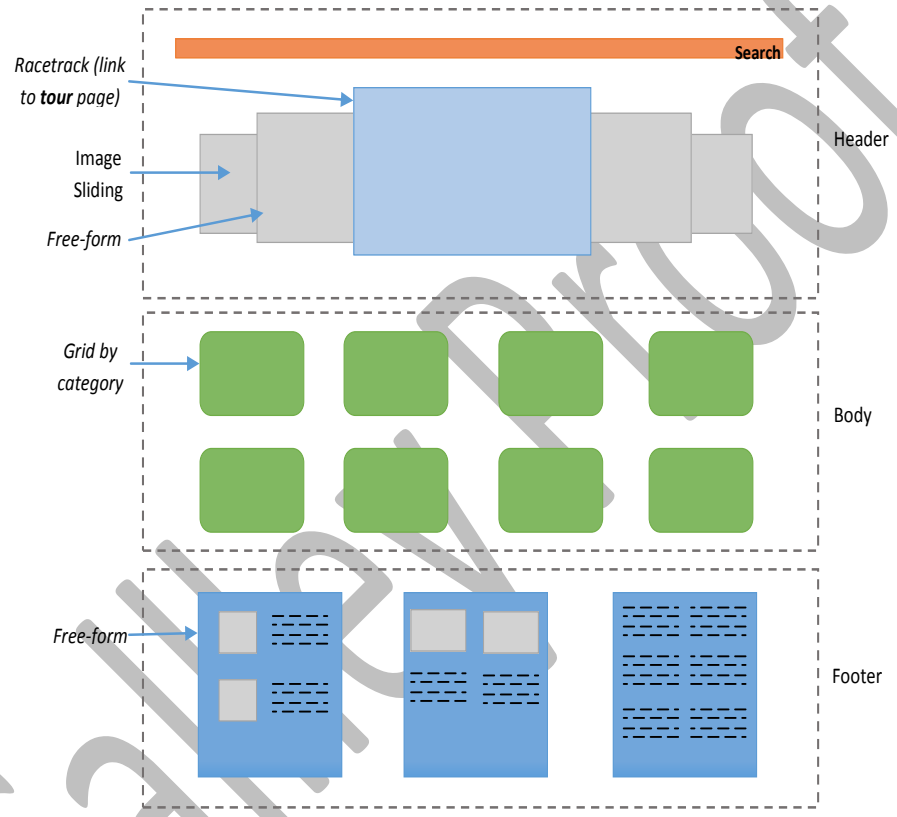

Fig. 5. Hybrid virtual store layout

In HVSL website, the display of three conventional store layouts can be performed in particular form and places. We divided the main structure of website into three, a header column for the main contents or even more in the middle while sidebars are put on the sides of the website. In this research, we display racetrack layout on the header, grid layout on the main content and free form on the sidebar or footer. For attracting customers to visit HVSL, interactive technology on the designed website can be added as Image Interactive Technology (IIT) or sliding image, interactive image (zoom-in functions) and 3D virtual model [29].

The proposed hybrid store layout in this research puts freeform layout on the header with image sliding which guides customers to other type of layout, racetrack. The reason that Racetrack use with this way is because they are assumed having long time spent within the store. *Free-form* layout in this proposed HVSL is displayed on the footer and header, while grid layout is put on the main page position that consist of more detail information of stuffs when clicked. For customers who have a limited time in shopping can use search menu. The expectation of applying VHSL are accommodating three conventional store layouts, giving a better experience in shopping and providing better customer service.

3. RESEARCH METHODOLOGY

Prior research about conventional store layout indicates that there is a relationship between virtual store layout and customer behavior. The impacts of virtual grid, freeform and racetrack layout has been tested to investigate the relation to customer behavior in Vrechopolous et. al [11]. This research uses variables adopted by Vrechopolous et. al [11] that the measures customers behavior on different conventional VSL can be approached with "*facilitating planned purchase (a), easy navigation within store (b), perceived entertainment (c), time spent within store (d) and website information style (e)"* to test whether and how the proposed virtual store layout (hybrid virtual store layout - HVSL) affects customers behavior in those terms of constructs. The use of first and second constructs this research are based on the theory of Technology Acceptance Model (TAM) which were developed by Davis [30], while the third construct followed the model from Lastovicka [31] and Vrechopoulos, O'Keefe, Doukidis, & Siomkos [32], then the complexity of information given by the website to customers is presented by website information style [33] and fourth construct is automatically measured by the system. The constructs relations for the application of HVSL are shown in Fig. 6.

Tabel. 1. characteristics of conventional VSL

Customers type	Purpose	Planned	Time
Grid	Purchase	yes	Short
Racetrack	Browsing	No	Long
Free-form	Browsing & plan to purchase	No	Medium

The following hypotheses apply in this research are set to test whether hybrid virtual store layout (HVSL) gives better results on each construct than the conventional VSL:

Hypothesis 1: Hybrid virtual store layout is easier to use than freeform VSL

There is a significant correlation between store layout in term of displaying products and the sales which indicate that customers consider the ease of finding their planned product to buy. Prior studies shows that online shoppers are influenced easily to switch or change their decisions to buy depends on the position and self price [11, 32, 34]. Vrechopoulos et al. [32] indicates that some store layout give different results in the ease of website operation by customers. For example, the grid layout is perceived easier to operate than other conventional store layout. Therefore, in this research, HVSL is believed to give a better perceived than the four conventional layouts.

Hypothesis 2: Hybrid virtual store layout is more entertain than racetrack VSL

Store layout design affects customer's perceive in spending their time in the store. According to Eroglu et.al [25], the length of time that customers spend on the website is influenced by the design of store layout. Vrechopoulos, et al. [32] found that freeform design is more entertaining than other types while there is no significant different in racetrack and grid store layout.

Hypothesis 3: Hybrid virtual store layout is more helpful than grid VSL

The type of store layout has significant effect on the degree of ease when customers browse their planned products. Davies [30] found that the efforts of customers to get their planned product, which could be also indicated by time spent in finding the products, is the indicator how easy the layout design is. On the other words, this hypothesis attempts to measure how ease the layout store drive the customers to find their planned product to purchase.

The layout of virtual store impact significantly to the length of time that customers spend shopping [32]. They found that racetrack and freeform layout and grid layout on virtual store have significant lies while no significance lies on freeform and racetrack.

Hypothesis 4: Customers in hybrid virtual store layout spend more time than freeform VSL.

Hypothesis 5: Customers in hybrid virtual layout are given more information on products displayed than freeform

It is theorized that the structure of virtual store has differing influence on customer's information gathering [14]. In some particular layouts, as tree and tunnel structures, the effort or mental energy consumed by customers to elaborate the virtual to get information regarding the products are different. It is better for a virtual layout to motivate customers in elaborating the store's information that lead them to purchase their planned products [35].

4. RESULTS AND ANALYSIS

The reliability of the construct in this research is tested using Cronbach's alpha test (shown in Table 2). The online polling is chosen to get respondents which are expected to answer all the provided questions. The number of sample who filled in the polling during August and September 2014 are 49 respondents.

Table 2 shows the reliability value uses Cronbach's alpha, which indicates that all the value of the questions are acceptable (Alpha > 0.700) or reliable. It is also shown that the first construct, the degree of ease, has the highest alpha which is the most reliable questions provided to respondents.

4.1 Hypotheses Testing

One-way between groups ANOVA parametric is used to test the hypotheses with post hoc comparison test (Tukey). The interpretation of ANOVA results are provided in the following Table. As summary, it is shown that the different layouts affect the variables in each constructs significantly.

In Table 3, which shows the ANOVA results with post hoc comparisons, indicates that there is a significant influence on layouts and the corresponding dependent variables. The first variable questioned to respondents about the degree of ease, the respondents perceived that grid layout is significantly more useful than other layouts in finding the proposed products within the virtual store with $p \leq 0.05$, which the hypothesis 1 is not supported. Comparing means of the questions in this construct each layout indicates that grid layout has the highest value and followed by hybrid layout, racetrack and freeform.

The three questions questioned to respondents about the degree of entertainment, the respondents perceived that grid layout is significantly more entertaining than other layouts with $p \leq 0.05$, which the hypothesis 1 is not supported for questions ENT1 and ENT2.

In the construct of entertainment variables with three questions asked to respondents whether hybrid model has interactive and entertaining layout shows that respondents' perceive in hybrid layout is better than the other two conventional layout, freeform and racetrack for all the 'entertainment' questions. It is also shown that hybrid layout is the best layout than the other conventional layout for question three (ENT3). However, grid virtual layout gives a bit higher mean value based on the respondent's perceive for the first (ENT1) and second (ENT2) questions (4.10 and 3.92) comparing hybrid layout mean (4.08 and 3.90).

Table 2. Reliability analysis (cronbach's alpha test)

Construct	Construct Items		Cronbach's alpha
Ease of use	E1	The product can be found easily	0.771
	E2	Layout is easy to use	
	E3	Layout provides you guidance to find the product	
Willingness to purchase	W1	Layout leads to find the targeted product	0.704
	W2	Product of position in the layout helps to search the product	
	W3	Products are classified in the right place	
Entertainment	Ent1	The layout is entertaining	0.710
	Ent2	The layout is attractive	
	Ent3	You enjoy while browsing the product	
Information	INF1	You can find product information clearly	0.714
	INF2	The layout provide detail information	
	IIN3	The products are grouped in the right position	

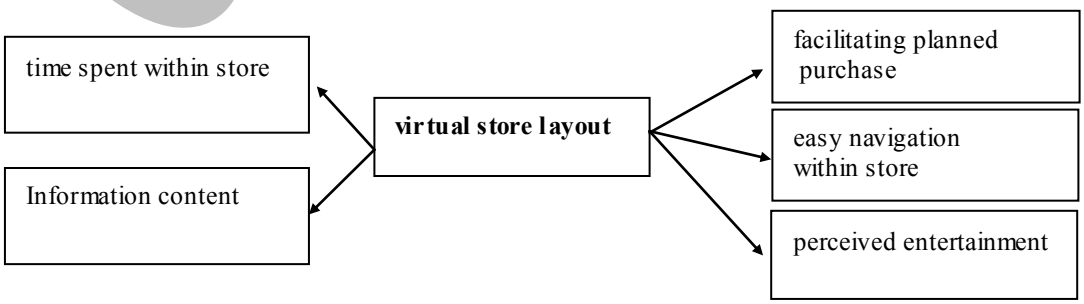

Fig. 6. Research constructs

Table 3. ANOVA parametric test

Alternative hypotheses	F	Sig.	Finding	Means	Tukey post hoc comparisons
Ease of use					
E1	4.198	0.007	Reject H0 at α = 0.05	Racetrack: 3.39 Grid:3.57 Freeform:2.71 Hybrid: 3.31	Racetrack>>freeform Grid>>freeform Hybrid>freeform Grid>Hybrid
E2	3.258	0.023	Reject H0 at α = 0.05	Racetrack: 3.31 Grid:3.82 Freeform:3.47 Hybrid: 3.35	Hybrid>racetrack Grid>>racetrack Grid>freeform Grid>hybrid
E3	13.704	0.00	Reject H0 at α = 0.05	Racetrack: 3.67 Grid:3.92 Freeform:2.73 Hybrid: 3.61	Racetrack>>freeform Grid>>freeform Hybrid>>freeform
Entertainment					
ENT1	23.056	0.00	Reject H0 at α = 0.05	Racetrack: 3.55 Grid:4.10 Freeform:2.73 Hybrid: 4.08	Racetrack>>freeform Grid>>racetrack Hybrid>>racetrack Hybrid>>freeform
ENT2	15.239	0.00	Reject H0 at α = 0.05	Racetrack: 3.57 Grid:3.92 Freeform:2.71 Hybrid: 3.90	Racetrack>>freeform Grid>>freeform Hybrid>>freeform Hybrid>racetrack
EnT3	18.107	0.00	Reject H0 at α = 0.05	Racetrack: 3.41 Grid:3.88 Freeform:2.78 Hybrid: 3.96	Racetrack>>freeform Grid>>racetrack Grid>>freeform Hybrid>>freeform
Information					
INF1	9.867	0.00	Reject H0 at α = 0.05	Racetrack: 3.45 Grid:3.57 Freeform:2.82 Hybrid: 3.90	Racetrack>>freeform Grid>>freeform Hybrid>>freeform Hybrid>grid Hybrid>racetrack
INF2	23.223	0.00	Reject H0 at α = 0.05	Racetrack: 3.45 Grid:3.57 Freeform:2.82 Hybrid: 3.90	Racetrack>>freeform Grid>>racetrack Grid>>racetrack Hybrid>>racetrack Hybrid>>freeform
INF3	25.797	0.00	Reject H0 at α = 0.05	Racetrack: 3.84 Grid:4.04 Freeform:2.61 Hybrid: 4.00	Racetrack>>freeform Grid>>freeform Hybrid>>freeform Hybrid>racetrack
Helpful					
W1	27.466	0.00	Reject H0 at α = 0.05	Racetrack: 3.55 Grid:4.12 Freeform:2.53 Hybrid: 4.04	Racetrack>>freeform Grid>>freeform Grid>>racetrack Hybrid>>freeform Hybrid>racetrack
W2	12.744	0.00	Reject H0 at α = 0.05	Racetrack: 3.32 Grid:4.02 Freeform:2.90 Hybrid: 3.90	Grid>>racetrack Grid>>freeform Hybrid>>racetrack Hybrid>>freeform
W3	31.916	0.00	Reject H0 at α = 0.05	Racetrack: 3.88 Grid:4.10	Racetrack>>freeform Grid>>freeform

Alternative hypotheses	F	Sig.	Finding	Means	Tukey post hoc comparisons
Time spent	43.59	0.00	Reject H0 at α = 0.05	Freeform: 2.49 Hybrid: 4.08 Racetrack: 3.20 Grid: 2.27 Freeform: 2.90 Hybrid: 1.63	Hybrid>>freeform Hybrid>racetrack Hybrid > grid Hybrid>>freeform Hybrid>>racetrack

Table 4. Test of validity of the questions of the degree of ease (E)

Ease of Use (E)	Racetrack	Grid	Freeform	Hybrid	Total
E-Racetrack	1				
Grid	0.620883	1			
Freeform	0.449452	0.438292	1		
Hybrid	0.39934	0.416862	0.567813	1	
Total	0.800363	0.785497	0.781407	0.760221	1

Table 5. Test of validity of the questions of the degree of entertainment (ENT)

Entertainment (ENT)	Racetrack	Grid	Freeform	Hybrid	Total
Racetrack	1				
Grid	0.333676	1			
Freeform	0.612697	0.590341	1		
Hybrid	0.417892	0.610532	0.616616	1	
Total	0.747687	0.76907	0.878383	0.822708	1

Respondent's perceive in gaining information from different layouts indicates that hybrid layout is superior than other conventional layout for question INF1 and INF2. However, for the question INF3, grid layout gives better mean value than the others. The third question to respondents about the degree of gaining information from the layouts shows that the respondents stated that grid layout is significantly more entertaining than other layouts with $p \leq 0.05$, which the hypothesis 3 is not supported for questions INF3.

On the degree of helpful, it shows that grid layout is the most helpful than the other layout including the hybrid layout. Therefore, the hypothesis 4 is not supported due to $p \leq 0.05$ for all the questions (W1, W2 and W3). As the comparisons, it is summarized that grid layout is superior than the others, while the hybrid layout is more helpful than racetrack and freeform layout.

On the time spent variable, the hybrid store layout is superior than the other store layouts. The average number of respondents spent their time for stuff finding within the store with mean values 1.62 comparing to grid layout (2.27) and racetrack and freeform layout (3.20 and 2.90). Based on Table 3, the hypothesis 5 which represent the time spent of respondents in finding their proposed products within store, is rejected on α = 005.

4.2 Test of Validity

Test of validity results indicate that all the instruments in this research construct are valid. For instance, the first three questions of the degree of ease (E1, E2 and E3) in all virtual store layouts is valid compared with total score, the value is more than 0.3 (see Table 4 above).

The validity test of the second questions related to the degree of entertainment indicates that the constructs are valid. It is shown in Table 5 above that all values of the constructs are more than 0.3, which is the freeform and hybrid virtual layout are the most correlated than the other layouts.

Table 6 shows that the values of the virtual store layouts are more than 0.3, which mean that all the questions constructed regarding the information gaining by customers are correlated. The high value of the validity test of this constructs; which is reaching 0.9 on average; indicates that there is a significant correlation in the questions developed.

The test of validity of the fourth questions related to the degree of helpful (W) indicates that the constructs are valid. It is shown in Table 7 that all values of the constructs are more than 0.3, which is the freeform and grid virtual layout are the most correlated than the other layouts.

Table 6. Test of validity of the questions of the degree of gaining information (INF)

Information (INF)	Racetrack	Grid	Freeform	Hybrid	Total
Racetrack	1				
Grid	0.703915	1			
Freeform	0.862603	0.726702	1		
Hybrid	0.769113	0.773243	0.788231	1	
Total	0.914591	0.880858	0.930845	0.913243	1

Table 7.Test of validity of the questions of the degree of helpful

Helpful (W)	Racetrack	Grid	Freeform	Hybrid	Total
Racetrack	1				
Grid	0.746738	1			
Freeform	0.751001	0.850658	1		
Hybrid	0.674023	0.844473	0.863882	1	
Total	0.870776	0.93837	0.941622	0.917863	1

5. CONCLUSION

This research focuses on the Indonesian customers perceived on the use of virtual retailer's layout. The respondents are provided with the proposed virtual design named hybrid virtual store layout (HVSL) to purchase products and investigate their perceived on using it. As result of significant increase of the use of online shopping due to the increase of internet worldwide, the retail layout model has impacted on customer's behavior on purchase virtually. Recent works indicates that there are three major virtual store layouts (grid, freeform and racetrack) which have been developed based on display of the products in order to ease, useful and effectiveness on choosing the customers planned product to purchase.

This research developed a new virtual store layout, which is called hybrid virtual store layout (HVSL), that customized the demand of customer's perceived on purchase based on the degree of ease, usefulness, willingness to purchase (helpful), entertaining and time spent on purchase. The outputs of the results found that the proposed HVSL gives better perceived of customers on time spent, usefulness and the degree of and helpful than conventional store layout as freeform and racetrack.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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